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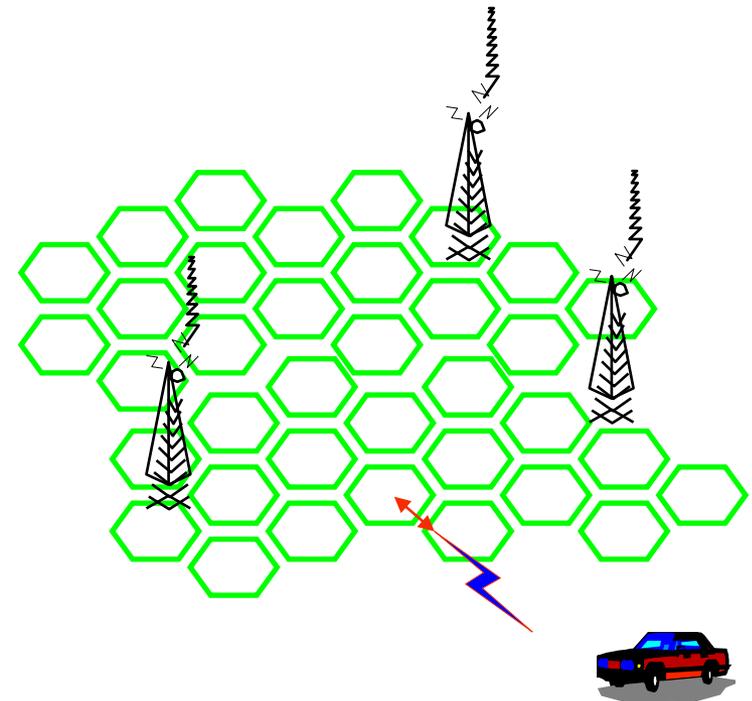
# ***Wireless Cellular Communications and Next-Generation GPS***

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During the last decade  
**Digital Cellular Technologies**  
have transformed the world  
by providing secure and  
reliable communications to  
anyone, anytime, anywhere.





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The leading wireless technology that has made this possible and currently provides service to **over 47%** of North American subscribers is

**CDMA Digital Cellular Radio**  
*(Code Division Multiple Access)*

(CDG, 3<sup>rd</sup> Qtr. 2004)





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**CDMA cellular technology** critically relies  
on **GPS** for everyday operations

**CDMA Cell sites** use high performance  
**GPS** timing receivers for synchronization

Almost all **CDMA** and **GSM** cell phones  
manufactured today contain an  
**embedded GPS** receiver to support **E911**





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**CDMA Cellular Systems** alone provide  
service to over **102 million** North  
American and over **285 million**  
worldwide subscribers

(CDG, 3<sup>rd</sup> Qtr. 2005)





## **CDMA Technology is deployed in over 75 countries worldwide including:**

- United States
- Canada
- Mexico
- Brazil
- Argentina
- Venezuela
- India
- Korea
- China
- Romania
- Russia
- Australia





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## Some of the many US Cellular Providers using CDMA Technology:

- Verizon
- Sprint
- Alltel
- Metro PCS
- Midwest Wireless
- Cellular South
- US cellular
- Leap
- NTELOS
- CellCom
- Pine Belt Tel & Wireless
- Wireless North





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## **Cellular system today are used for:**

- **Voice communication**
- **Wireless data network access**
- **E911 (approx. 240,000 US E911 calls daily)**
- **Vehicle and asset tracking**
- **Remote system monitoring**
- **Public safety backup communications**





## CDMA Cell Site equipment uses GPS for:

- Cell Site Identification
- RF signal encryption
- Frequency and timing accuracy
- Data synchronization
- Providing UTC time and date to users
- Assisting mobiles in E911 location determination





## Mobile equipment uses GPS for:

- **Wireless caller E911 location determination**
- **Vehicle tracking, recovery and remote assistance**
- **Person or asset monitoring and tracking**
- **Remote process monitoring and control**
- **Location based services (LBS)**
- **Many new applications being developed**





# Wireless E911 location determination

FCC mandated Wireless **Enhanced 911 (E911)** requires that service providers using a handset based (GPS) solution be able to provide a callers location to a Public Safety Answering Point (PSAP) to within **50 meters 67% of the time, and 150 meters 95% of the time.**





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To help indoor and urban located mobiles overcome GPS signal acquisition limitations, and achieve a rapid time-to-first-fix (TTFF), cell phones use an enhancement called **Assisted-GPS (A-GPS)** which uses the cellular network to provide GPS ephemeris and navigational data over high speed control channels.





## **A-GPS location determination performance continues to be challenged by:**

- **Indoor reception limitations**
- **Poor GPS L1 C/A altitude determination**
- **Narrowband interference to GPS L1 C/A**
- **New LBS applications requiring more accurate location determination**





## Next Generation GPS Signal Options

- **L2C / L5** - Future CDMA cell sites may use L2C or L5 for frequency diversity, improved timing performance and reliability, and complete in-building solutions.
- **L2C** should significantly improve the position determination performance of mobile equipment and resolve many of the E911 A-GPS problems presently experienced using L1 C/A

Note – Over the next decade, our Euro customers will also require Galileo support





## **L2C advantages over L1 C/A that will improve mobile position determination:**

- **24 dB better Cross-correlation protection**
- **6 dB better Carrier tracking threshold**
- **2.7 dB better Data recovery threshold**
- **More compact CNAV message structure**

**L5 has additional advantages, but due to the higher overhead needed, it is only being considered for high performance applications such as in cell sites.**





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## Next-Generation GPS Benefits Summary

- **Better in-building and urban lock to GPS signal**
- **More accurate positioning for E911 and LBS**
- **Reduced impact of narrowband interference**
- **Smaller, complete in-building cell sites**
- **Lower cost data resynchronization equipment**

